

**CHARACTERIZATION OF SURFACE-WATER RESOURCES IN THE GREAT  
BASIN NATIONAL PARK AREA AND THEIR SUSCEPTIBILITY TO GROUND-  
WATER WITHDRAWALS IN ADJACENT BASINS, WHITE PINE COUNTY,  
NEVADA**

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Eight drainage basins and one spring within the Great Basin National Park area were continuously monitored from October 2002 to September 2004 to quantify discharge and assess the natural variability in streamflow. Mean annual discharge for the stream drainages ranged from 0 ft<sup>3</sup>/s at Decathon Canyon to 9.08 ft<sup>3</sup>/s at Baker Creek. Seasonal variability in streamflow generally was uniform throughout the network. Minimum and maximum mean monthly discharges occurred in February and June, respectively, at all but one of the perennial streamflow sites. Synoptic discharge, specific conductance, and water-temperature measurements were collected during the spring, summer, and fall of 2003 along selected reaches of Strawberry Creek, Shingle Creek, Lehman Creek, Baker Creek, Snake Creek, and Big Wash to determine areas where surface-water resources would be susceptible to ground-water withdrawals in adjacent basins. Comparison of streamflow and water-property data to the geology along each stream indicated areas where surface-water resources would likely or potentially be susceptible to ground-water withdrawals. These areas consist of reaches where streams (1) are in contact with permeable rocks or sediments, or (2) receive water from either spring discharge or ground-water inflow.

## **Preliminary Estimates of Natural Ground-Water Discharge from Phreatophytes along the Muddy River, Nevada**

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The Muddy River and Muddy River Springs lie within a ground-water flow system known as the Colorado River Regional Flow System (CRFS), which is located in the Carbonate-Rock Province of the Great Basin region in southern and eastern Nevada. Within the flow system, spring discharge provides natural surface-water flow that supports a relatively large area of riparian vegetation along the Muddy River. Natural-resource managers are concerned that ground-water development in the Muddy River Springs and adjacent Coyote Spring Valley may reduce spring and surface-water flow and adversely impact aquatic and riparian ecosystems.

Natural discharge from riparian areas along the Muddy River occurs primarily by evapotranspiration (ET). Therefore, quantification of ET from these areas is essential for accurate estimates of basin and regional water budgets.

A cooperative 5-year study between the U. S. Geological Survey and various DOI Bureaus [the National Park Service, the U.S. Fish and Wildlife Service, and the Bureau of Land Management] is underway to quantify ET by phreatophytic vegetation in support of a regional water-budget model. The study area consists of 12 selected hydrographic areas in the central CRFS which includes the Muddy River and surrounding areas. For this study, natural ground-water discharge by ET is estimated by (1) delineating areas of phreatophytic vegetation with similar ET characteristics (ET units) using multi-spectral satellite imagery, (2) computing representative annual ET rates for ET units using measurements from micrometeorological and soil data-collection stations located within the study area, and (3) calculating annual ground-water discharge by taking the product of ET unit area and its representative ET rate. This approach to estimating natural ground-water discharge has been successfully used in many areas of southern Nevada and southeastern California.

In support of the study, an ET data-collection station was installed along the Muddy River, near Moapa, in a high- to moderate-density stand of mesquite trees. Approximately 4,000 acre-ft of ground-water is discharged by ET annually by more than 2,000 acres of phreatophytic vegetation, based on preliminary estimates of annual ground-water discharge by ET for two years in the Muddy River and the Muddy River Springs area and ET rates from other published studies in southern Nevada.

# **BARCASS: An integrated, multi-agency hydrogeologic study of east-central Nevada**

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Federal legislation (Section 301(e) of the Lincoln County Conservation, Recreation, and Development Act of 2004; short title, Lincoln County Land Act) was enacted in December 2004 to better understand and evaluate regional ground-water flow systems in Nevada, and initiate long-term studies of potential impacts from future ground-water pumping. The legislation states that: “The Secretary, acting through the United States Geological Survey, the Desert Research Institute, and a designee from the State of Utah shall conduct a study to investigate ground water quantity, quality, and flow characteristics in the deep carbonate and alluvial aquifers of White Pine County, Nevada, and any groundwater basins that are located in White Pine County, Nevada, or Lincoln County, Nevada, and adjacent areas in Utah”.

In response to this legislation, the U.S. Geological Survey (USGS), in cooperation with the Desert Research Institute (DRI) and the Utah State Engineers Office, initiated the BARCASS (Basin and Range Carbonate Aquifer System Study). BARCASS identified six primary work elements:

1. Evaluate hydrogeologic controls on ground-water flow through carbonate and alluvial aquifers, and determine the approximate volume of water stored in those aquifers by evaluating data on aquifer thickness, extent, structural characteristics, and hydraulic properties.
2. Develop estimates of mean annual recharge and discharge (discharge components include evapotranspiration, pumpage, streamflow, and springflow) using geographic information system analysis, the collection of new atmospheric data, and remote-sensing techniques.
3. Evaluate principal ground-water flow paths using existing and newly acquired water-level data that represent the basin-fill and regional ground-water flow systems, and develop maps that represent the altitude of static water levels in wells within the flow system.

4. Collect and analyze new geochemical data to support hydrologic evaluations of the magnitude and distribution of recharge, ground-water flow direction, and ground-water travel times, and describe the chemical quality of ground water.
5. Store existing and any newly collected hydrologic data from each work element in the USGS National Water Information System and develop a public web site for dissemination of study information.
6. Synthesize and evaluate the results of all work elements to estimate basin water budgets, develop a three-dimensional conceptual description of regional ground-water flow, and prepare a final report documenting the results of the study.

The study must be completed within 36 months beginning December 2004. The results of each work element will be summarized into one USGS Scientific Investigations Report; the draft publication will be available for public comment no later than June 1, 2007, and published no later than December 1, 2007.

# **Estimated annual evapotranspiration by phreatophytic vegetation in east-central Nevada and western Utah using the eddy-covariance method – update of progress on the BARCAS study**

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In response to congressional legislation, the U.S. Geological Survey, in cooperation with the Desert Research Institute and the Utah State Engineers Office, initiated the BARCAS (Basin and Range Carbonate Aquifer System) study in December 2004. The principal objective of the study is to integrate existing and new geologic, hydrologic, and supplemental geochemical data to determine ground-water budgets for 13 hydrographic basins in White Pine County, Nevada. As part of this objective, spatially-distributed estimates of mean annual ground-water discharge will be developed by quantifying evapotranspiration from open water and phreatophytic vegetation, springflow, and ground-water withdrawals.

Several different measurement and extrapolation techniques are being applied to refine previous estimates of evapotranspiration. As part of the BARCAS study, field studies designed to collect data to estimate evapotranspiration at different spatial scales are progressing. Evapotranspiration data are being collected at near-point scale using a static chamber dome and at the plant-community or fetch scale, using eddy-covariance towers. This update reports on progress made in acquiring and analyzing eddy-covariance data.

# **Estimated ground-water withdrawals from selected hydrographic basins in east-central Nevada and western Utah – update of progress on the BARCAS study**

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Annual ground-water withdrawals for 2000, 2002, and 2005 are being estimated for the study area using available data and remotely-sensed multi-spectral imagery to identify irrigated fields. Estimates for irrigation use will be computed using a volumetric calculation—irrigated acreage multiplied by an appropriate field application rate. Domestic and other uses (public supply, commercial, mining, stock, recreational, and industrial) will be estimated from information contained in available State and Federal reports and databases.